

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
22 September 2005 (22.09.2005)

PCT

(10) International Publication Number
WO 2005/088210 A1

(51) International Patent Classification⁷: **F25B 9/00**

(21) International Application Number:
PCT/US2005/007981

(22) International Filing Date: 8 March 2005 (08.03.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/551,154 8 March 2004 (08.03.2004) US

(71) Applicants (for all designated States except US): **SUM-ITO HEAVY INDUSTRIES, LTD.** [JP/JP]; Intellectual Property Department, 9-11, Kitashinagawa 5-chome, Shinagawa-ku, Tokyo 141-8686 (JP). **SHI-APD CRYOGENICS, INC.** [US/US]; 1833 Vultee Street, Allentown, PA 18103-4783 (US).

(72) Inventors; and

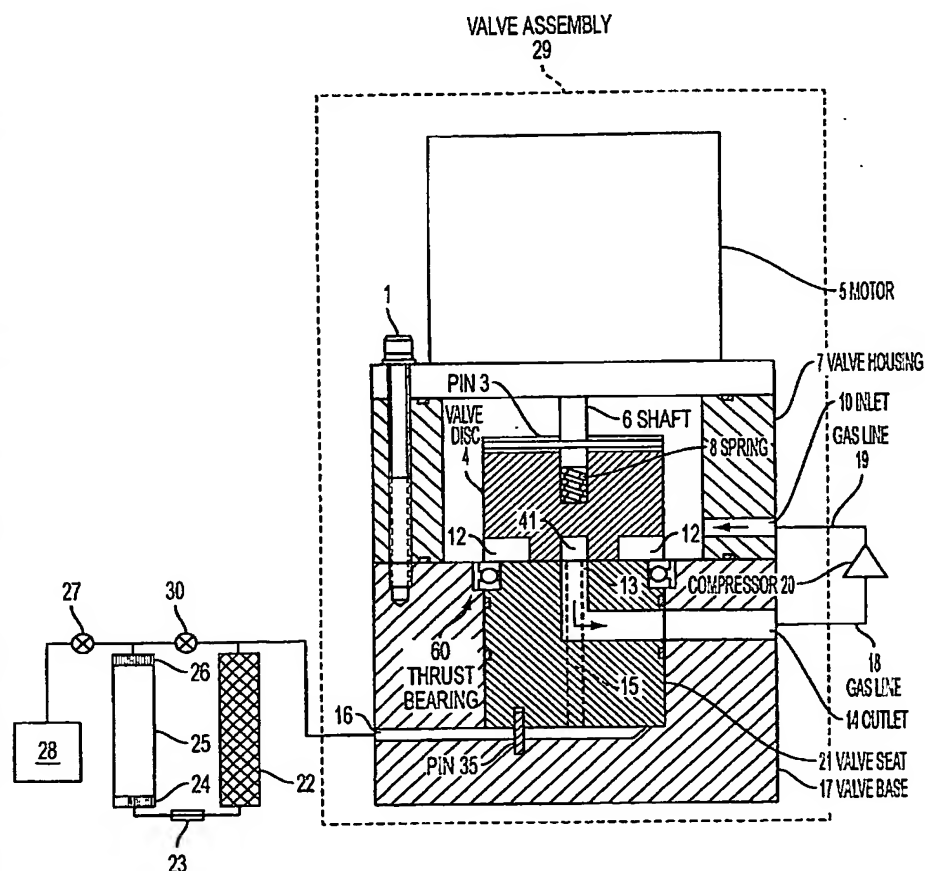
(75) Inventors/Applicants (for US only): **SEITZ, Eric** [US/US]; 5787 Fresh Meadow Drive, Macungie, PA 18062 (US). **GAO, Jin-Lin** [CN/US]; c/o Shi-APd Cryogenics, INC., 1833 Vultee Street, Allentown, PA 18103-4783 (US). **LONGSWORTH, Ralph, C.** [US/US]; 1833 Vultee Street, Allentown, PA 18103 (US). **XU, Mingyao** [CN/US]; 130 Cold Stream Court, Emmaus, PA 18049 (US).

(74) Agents: **HELFGOTT, Samson et al.**; Katten, Muchin, Zavis, Rosenman, 575 Madison Avenue, New York, NY 10022-2585 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,

[Continued on next page]

(54) Title: **WEARLESS VALVE FOR CRYOREFRIGERATOR**



(57) Abstract: An improved method of reducing wear dust and torque required to turn a multi-port rotary disc valve utilizes a thrust bearing to hold the valve seat and/or valve disc such that they are not in contact with each other, or have light contact each other.



MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.